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Understanding the growth of nanoscale organic semiconductors: the role of substrates[1] MINA YOON, KAI XIAO, KENDAL W. CLARK, ANPING LI, DAVID GEOHEGAN, BOBBY SUMPTER, SEAN SMITH, Center for Nanophase Materials Sciences, Oak Ridge National Laboratory, CENTER FOR NANOPHASE MATERIALS SCIENCES, OAK RIDGE NATIONAL LABORATORY TEAM — Our recent studies have demonstrated how substrates can be used to control the synthesis of nanoscale organic semicorductors. In particular, we study the growth mechanism of oriented crystalline organic nanowires consisting of M-TCNQF4 (M=Cu or Ag) from vapor-solid chemical reaction (VSCR). Our experimental and theoretical study combining time-resolved in situ X-ray diffraction and first-principles atomistic calculations indicate that the selectivity of different metals to induce nanowire growth depends strongly upon effective charge transfer between the organic molecules and the metal substrates. Understanding how to control the VSCR growth process may enable the synthesis of novel organic nanowires with axial or coaxial p/n junctions for organic nanoelectronics and solar energy harvesting. Another example is the growth of another promising organic semiconductor, CuPc assemblies on graphene(s) and Si substrates, where we investigate the role of the substrates in controlling the orientational arrangement of the molecules and their growth modes. Our theoretical study supports the various experimental observations from STM, TEM, and GIXS.

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